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Northern Telecom Inc.
801 Pennsylvania Avenue, N.W.
Suite 700
Washington, DC 20004
Tel. (202) 347-4610

May 13, 1994

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Mr. William Caton
Acting Secretary
Federal Communications Commission
Room 222
1919 M Street, NW
Washington, D.C. 20554

RE: Ex Parte Presentation GEN Docket No. 90-314

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's rules, you are hereby notified that Ron Cross, Director, Regulatory Policy Analysis, Northern Telecom and the undersigned met with Byron Marchant of Commissioner Barrett's office on May 10, 1994. The purpose of the meeting was to discuss the need for increased power for licensed PCS. In response to a question raised by Mr. Marchant, the attached written information is also being provided.

An original and one copy of this communication are enclosed

If you have any questions, please communicate with the undersigned.

Sincerely,

Raymond L. Strassburger
Director, Government Relations - Telecommunications Policy

RLS/gj
Attachment

cc: Byron Marchant

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Analysis of the Impact of an Increased Base Station Power on Multiple PCS Systems Operation

Scope:

This document represents a brief analysis of the impact of an increased base station radiated power on operations of multiple PCS systems located in the same area and operating in adjacent PCS bandwidths.

It shows that increasing the PCS base station output power has no impact on the in-band spurious level since the required interference attenuation, defined by the Commission, already takes into account variable output power. On the other hand, out-of band spurious emissions will always require some kind of coordination between multiple PCS systems for any power in the range from 100W to 1600W.

Objectives, Methodology, and Technical Background:

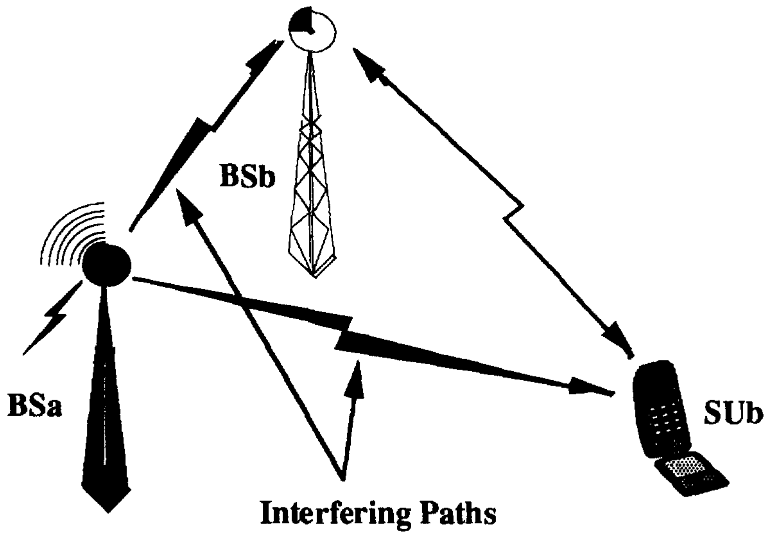
The Commission in its PCS Second Report and Order released October 22, 1993, has defined a 100 W (50 dBm) per channel EIRP limit for the PCS base stations operating in the licensed bandwidths (blocks A, B & C or D, E, F & G, frequency bands: 1850-1890 MHz coupled with 1930-1970 MHz and 2130-2150 coupled with 2180-2200 MHz).

Increased base station output power has been proposed by many companies, including Northern Telecom, in their petitions for reconsideration, comments and reply comments to the PCS Second Report and Order. A EIRP limit of 1600 W (62 dBm) has been proposed in many comments to the Commission's Rules.

The intent of this document is to analyze the consequence of increasing the allowed EIRP limit on concurrent operations of multiple PCS systems, and especially to analyze the impact on the operation of two different PCS networks operating in the same area on two adjacent PCS frequency blocks.

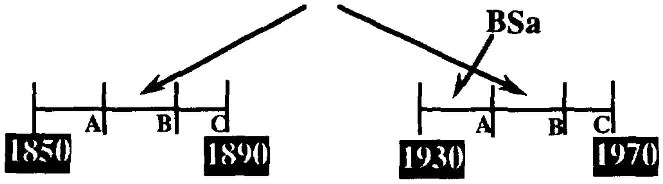
For clarity we assume in the analysis, without introducing any limitation, that PCS system A, operating in spectrum block A, will be considered as the spurious generator, and PCS system B operating in spectrum block B in the same area (MTA or BTA) as system A will be the jammed system. We will call system A base stations BSa, and system A subscriber units SUa. We will call system B base stations BSb, and system B subscriber units SUb.

The objective of the analysis is to define what are the in-band and out-of-band spurious levels received by BSb and SUb, from the base station BSa, and specifically how these spurious levels are impacted by base station radiated power increased from 100 W to 1600 W. The following figure gives a simple representation of the spurious paths:



Interfering Paths

The next figure gives a spectral representation of the operating bands of the two systems. In this figure, BSa is supposed to operate in the higher part of Block A. BSb and SUb might operate either in the higher part or the lower part of block B, or in both depending if system B is a FDD or a TDD system, and if it is FDD which band has been selected for each direction[1].



A detailed and complete analysis of the mutual interference issue between system A and system B requires defining the spurious levels received from BSa at both BSb and SUb, for in and out-of-band emissions.

[1]: Northern Telecom in its Comments to the Second Report and Order has proposed that the Commission recommend that all FDD systems use the higher part of their allocated band for the base station to subscriber unit direction, and the lower part of their allocated block for the subscriber unit to base station direction. The same proposal has been submitted to the JTC Committee and been adopted. TDD systems would be able to operate is either part of the allocated block, obviously in both directions, with the simple limitation that the system components (base station and mobile station) would be subject to base station power limitations in the higher part of band and to subscriber unit/mobile station power limitation in the lower part of the band.

In band spurious emissions means those spurious signals generated by BSa in block B and received by either BSb or SUb.

Out of band spurious emissions means signals radiated by BSa outside block B, but which can induce a performance degradation in BSb or SUb receiver due to their high power level (effect known as blocking or spurious responses).

To define the received power level at BSb and SUb we need to make assumptions on the relative position of both base stations and the mobile stations, or make an assumption on the worst case coupling losses between both base stations and base station BSa and mobile station SUb. The worst case coupling losses represents the minimum loss affecting the BSa radiated signal to reach either BSb or SUb.

The worst case coupling loss depends on relative positions of base stations and the mobile station in realistic conditions, relative antenna pattern positions, potential in building penetration losses, and other factors.

The response of the systems to in-band and out-of-band spurious emissions is also an important parameter which should be taken into account. This spurious response is likely to depend on the system technology; TDD or FDD; SCPC, TDMA or CDMA; narrow band or broad band.

The following simplistic analysis is to define the impact of increasing the base station power on interference as described above.

The simple assumptions are:

- In-band spurious emissions power level should be computed according to the interference attenuation level defined by § 99.234 of the new rules ($43+10\log_{10}P$ or 80 dB, whichever is the lesser attenuation),
- Out-of-band spurious emissions power level should correspond to the actual power of the signal transmitted by BSa.

We consider that the worst case coupling losses should be:

- 30 dB between BSa and BSb assuming both base stations use the same mast where both systems antennae are located,
- 70 dB between BSa and SUb which corresponds approximately to the free space losses with BSa and SUb located 40 feet apart (or 10 meters), plus 10 dB of supplementary attenuation due to antenna mis-alignment[2]

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[2]: The 10 dB supplementary losses can be discussed. However, its impact is very low on the final result, shown in the next section, and can be easily verified. The supplementary losses are just present to identify that if the mobile station is very close to the antenna, it is not likely to be aligned with the actual antenna maximum gain direction, otherwise, the subscriber unit has to be at the same height as the antenna (inside a building), and then a supplementary in-building penetration loss needs to be included.

Interference Results:

In Band spurious:

The following table gives the in-band spurious levels received at BSb and SUb when BSa power is set to 100W and 1600W.

P	**BSa power (W):**	100	1600		
X	**BSa Power (dBm):**	50	62		
A	**Spurious attenuation (dB):**	63	75		43+10logP or 80
p	**Radiated Spurious Level (dBm):**	-13	-13		p=X-A

Cb	**Minimum Coupling losses BSb (dB):**	30	30		
I	**In-band received level at BSb (dBm):**	-43	-43		I=p-Cb

Cs	**Minimum Coupling losses SUb (dB):**	70	70		
I	**In-band received level at SUb (dBm):**	-83	-83		I=p-Cs

The table shows that with the current definition of the interference emissions, the higher the radiated power, the higher the required attenuation, such that <u>the bottom line result is the same for 100W transmitted power and 1600W transmitted power</u>[3].

Out-of-Band spurious:

The following table gives the out-of-band spurious levels received at BSb and SUb when BSa power is set to 100 W and 1600W.

P	**BSa power (W):**	100	1600		
X	**BSa Power (dBm):**	50	62		

Cb	**Minimum Coupling losses BSb (dB):**	30	30		
I	**Out-of-band received level at BSb (dBm):**	20	32		I=X-Cb

Cs	**Minimum Coupling losses SUb (dB):**	70	70		
I	**Out-of-band received level at SUb (dBm):**	-20	-8		I=X-Cs

3: The result of the analysis gives high interference levels likely not to be acceptable by either BSb (if system B is a TDD system or if system B is a FDD system receiving in the higher portion of block B), and by SUb (in the same conditions). This means that a frequency band allocation is required for each direction of FDD systems, and a distance coordination is required between TDD systems and FDD systems.

Obviously, as the BSb or SUb spurious signal is actually the BSa useful signal, the spurious received power depends on the radiated power.

Then increasing the power by 12 dB results in an increase of the spurious signal by 12 dB as well.

However, in both cases, the resulting levels are likely to be unacceptable by both BSb and SUb, especially if system B is a TDD system which covers the overall bandwidth corresponding to block A, B and C. The only way to guarantee safe operation in both cases is to coordinate the frequency allocation of both signal direction in FDD systems, and to guarantee a minimum distance between base station in case of TDD systems. The coordination process will have to take into account for the 12 dB increased power of the out-of-band spurious emissions when the output power is increased to 1600 W EIRP, which makes it barely more difficult[4].

Conclusion:

The present analysis has demonstrated the low impact of increasing the transmit power of a PCS base station from 100 W to 1600W EIRP, on the mutual interference of two systems operating on two adjacent bandwidth.

Either the spurious levels have been found to be identical in both cases (in-Band spurious), or so high that a frequency and distance coordination will always be required (out-of band spurious).

[4]: Following is an example where both system A and B are FDD systems with the lower part of the band used for the reverse (mobile station to base station) direction. Assume both the mobile and the base station can handle out of band spurious levels of 0 dBm. The mobile station SUb would be able to handle both received levels providing the 70 dB coupling losses are met. The separation distance between base stations antennae should be 50 feet if the base station power is 100 W, and the separation distance should be 150 feet if the base station power is 1600 W (approximate figures -- they also depend on the antennae patterns and actual pointed directions).